مركز المستشار الوطني للتدريب
National Consultant Centre For Training

5-Day Cement Industry Training Course
In

HYDRAULIC AND PNEUMATIC SYSTEMS FOR CEMENT EQUIPMENT

Dubai - UAE, 31 Aug. – 04 Sep. 2026

COURSE LEVEL: INTERMEDIATE

COURSE OVERVIEW:

Hydraulic and pneumatic systems are the "muscles" of a cement plant, providing the immense force and precise control required for heavy-duty operations. This course defines the principles of fluid power, focusing on the systems that drive kiln rollers, mill hydraulics, grate cooler drives, and pneumatic transport. By understanding the behavior of pressurized fluids and gases, participants will learn how to maintain, troubleshoot, and optimize these critical mechanical systems.

The scope of this training includes the technical study of pumps, valves, actuators, and compressors used in the cement environment. It covers the interpretation of hydraulic and pneumatic schematics, the management of fluid contamination, and the importance of "Safe Isolation" during maintenance. Furthermore, the course addresses the specific challenges of operating fluid power systems in high-dust and high-temperature conditions typical of a cement facility.

Coverage includes detailed modules on proportional valve technology, accumulator safety, and the optimization of pneumatic "Air Cannon" systems for preheater cleaning. Through practical workshops and the analysis of circuit diagrams, participants will learn how to diagnose "Pressure Loss" and "Slow Response" issues. Attendees will gain the technical proficiency required to ensure the reliability and longevity of the plant's hydraulic and pneumatic assets.

COURSE OBJECTIVES:

After completion of this course, the participants will be able to:

- Explain the physical principles of Pascal's Law and fluid power.
- Identify the symbols and components in hydraulic and pneumatic schematics.
- Describe the operation of piston, vane, and gear pumps.
- Understand the function of pressure, flow, and directional control valves.
- Manage "Fluid Contamination" through effective filtration and sampling.
- Maintain "Hydraulic Accumulators" and understand their safety risks.
- Troubleshoot "Grate Cooler" hydraulic drive systems.
- Optimize "Vertical Roller Mill" (VRM) hydraulic pressure circuits.
- Design and maintain "Pneumatic Air Cannon" systems.
- Perform safe "Bleeding" and "Priming" of hydraulic circuits.
- Identify the causes of "Cavitation" and "Aeration" in pump systems.
- Execute a comprehensive preventive maintenance plan for fluid power systems.

TARGET AUDIENCE:

This course is intended for Mechanical Technicians, Maintenance Supervisors, Hydraulic Specialists, and Millwrights.

TRAINING COURSE METHODOLOGY:

A highly interactive combination of lectures, discussion sessions, and case studies will be employed to maximize the transfer of information, knowledge, and experience. The course will be intensive, practical, and highly interactive. The sessions will start by raising the most relevant questions and motivating everybody to find the right answers. The attendants will also be encouraged to raise more of their questions and to share in developing the right answers using their analysis and experience. There will also be some indoor experiential activities to enhance the learning experience. Course material will be provided in PowerPoint, with necessary animations, learning videos, and general discussions.

The course participants shall be evaluated before, during, and at the end of the course.

COURSE CERTIFICATE:

National Consultant Centre for Training LLC (NCC) will issue an Attendance Certificate to all participants completing a minimum of 80% of the total attendance time requirement.

COURSE OUTLINE / COURSE CONTENT:

MODULE 1: PRINCIPLES OF FLUID POWER

- Introduction to Hydraulics (Liquids) vs. Pneumatics (Gases).
- Advantages and limitations of fluid power in cement plants.
- Understanding pressure, force, area, and flow relationships.
- Energy conservation and efficiency in fluid systems.
- Safety hazards of pressurized fluids and "Injection Injuries."

MODULE 2: HYDRAULIC PUMPS AND POWER UNITS

- Operating principles of fixed vs. variable displacement pumps.
- External and internal gear pump applications.
- Axial and radial piston pumps: Maintenance and adjustment.
- Components of the Hydraulic Power Unit (HPU): Tank, breathers, and heaters.
- Pump "Cavitation" and "Aeration": Causes and cures.

MODULE 3: CONTROL VALVES AND ACTUATORS

- Directional control valves: Spool types and actuation methods.
- Pressure control: Relief, reducing, and sequence valves.
- Flow control: Compensated vs. non-compensated valves.
- Linear actuators (Cylinders): Seals, cushions, and mounting.
- Rotary actuators and hydraulic motors for conveyor drives.

MODULE 4: PROPORTIONAL AND SERVO VALVE TECHNOLOGY

- Introduction to electro-hydraulic control systems.
- Operation of proportional solenoids and feedback sensors.
- Using proportional valves for precise "Mill Pressure" control.
- Troubleshooting electrical vs. hydraulic faults in "Ex" areas.
- Calibration of proportional valve drivers and amplifiers.

MODULE 5: HYDRAULIC FLUIDS AND FILTRATION

- Selecting the right hydraulic oil: Viscosity and additives.
- Impact of temperature on oil life and system performance.
- Contamination control: Understanding the ISO 4406 cleanliness code.
- Types of filters: Suction, pressure, and return line.
- On-site oil sampling and interpretation of lab reports.

MODULE 6: ACCUMULATORS AND SAFETY SYSTEMS

- Bladder, piston, and diaphragm accumulator types.
- Function of accumulators: Energy storage and shock absorption.
- Safety protocols for "Charging" and "Discharging" nitrogen.
- Accumulator safety blocks and "Manual Dump" valves.
- Inspecting and testing accumulator integrity.

MODULE 7: HYDRAULICS IN KILN AND COOLER SYSTEMS

- Operating the "Grate Cooler" hydraulic drive and stroke control.
- Kiln "Thrust Roller" hydraulic systems: Balancing kiln movement.
- Hydraulic "Brake" systems for large process fans.
- Managing the "Cooler Inlet" hydraulic damper controls.
- Troubleshooting "Sync" issues in multi-cylinder drives.

MODULE 8: VERTICAL ROLLER MILL (VRM) HYDRAULICS

- Design of the "High-Pressure" hydraulic circuit for grinding rollers.
- Managing the "Rocking" and "S-Curve" pressure profiles.
- Hydraulic "Lift and Swing" mechanisms for roller maintenance.
- Troubleshooting pressure "Spikes" and "Instability" in the mill.
- Maintenance of the VRM hydraulic cylinders and rod seals.

MODULE 9: PNEUMATIC SYSTEM FUNDAMENTALS

- Operation of screw and reciprocating air compressors.
- Air treatment: Dryers, filters, and lubricators (FRL units).
- Pneumatic cylinder control and "Speed Control" valves.
- Managing "Compressed Air Leaks" to save energy.
- Safety requirements for pressurized pneumatic vessels.

MODULE 10: AIR CANNON SYSTEMS AND PREHEATER CLEANING

- Design and function of high-velocity "Air Cannons."
- Solenoid valve control and automated firing sequences.

- Maintenance of air cannon "Piston" and "Seat" assemblies.
- Safety protocols for working near pressurized air cannons.
- Troubleshooting "Misfires" and "Air Leakage" in the tower.

MODULE 11: SCHEMATIC READING AND TROUBLESHOOTING

- Systematic approach to "Fault Diagnosis" in fluid circuits.
- Interpreting ISO symbols for pumps, valves, and lines.
- Using "Pressure Gauges" and "Flow Meters" for diagnostics.
- Logical troubleshooting: From the actuator back to the pump.
- Case studies: Solving chronic hydraulic overheating issues.

MODULE 12: COURSE CONCLUSION AND ASSESSMENT

- Practical exercise: Building and testing a basic circuit.
- Final exam on hydraulic and pneumatic systems.
- Review of "Maintenance Best Practices."
- Course feedback and closing remarks.